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Technical Note N-587

PIONEER POLAR STRUCTURES -

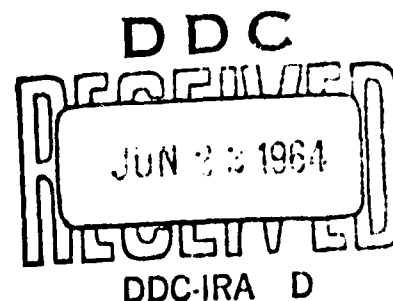
ERECTION OF PORTABLE MAINTENANCE SHELTER

BY

R. W. Hansen  
G. E. Sherwood

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U. S. NAVAL CIVIL ENGINEERING LABORATORY  
Port Hueneme, California

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## **PIONEER POLAR STRUCTURES -**

### **ERECTION OF PORTABLE MAINTENANCE SHELTER**

**Y-P015-11-01-143**

**Type C**

**by**

**R. W. Hansen and G. E. Sherwood**

#### **ABSTRACT**

The U. S. Naval Civil Engineering Laboratory, Port Hueneme, California, has developed a shelter for the maintenance and repair of construction and other equipment in pioneer polar camps. The shelter, which is 20 by 24 feet, will accommodate equipment as large as a standard Size 4 tractor. It consists of a skid-mounted aluminum frame of knock-down construction and a canvas cover. Accessories include a gantry-mounted, 2-ton traveling hoist, an electrical harness, and a personnel side entry. An 8- by 20-foot skid-mounted wanigan outfitted with tools and shop equipment has been developed as a companion item for the shelter. It is called an equipment-repair wanigan. This technical note provides a guide for erecting and outfitting the shelter and the wanigan.

An electrical generator is not provided with the shelter and the wanigan. A 5-kw unit is required for this service. A heater is not provided for the shelter, but the wanigan is equipped with a 27,000-Btuh oil-fired space heater. The shelter is designed for heating with a portable fresh-air heater such as the one included on the utility service sled developed by the Laboratory (See NCEL Technical Report R-276).

A detail description of the portable maintenance shelter is given in NCEL Technical Report R-317, and a detail description of the NCEL family of wanigans is given in NCEL Technical Report R-309.

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### PART I. PORTABLE MAINTENANCE SHELTER

#### GENERAL DESCRIPTION

The 20- by 24-foot portable maintenance shelter (Figure 1) includes:

1. An aluminum frame consisting of arch ribs at 4-foot spacing mounted on aluminum skids.
2. A canvas cover with blankets on the sides and over the arch and horizontal sliding curtains on the ends.
3. End struts to support the curtains in high winds.
4. An electrical harness which provides general lighting and outlets.
5. An optional personnel side-entry door.

The shelter components are listed in Table I.

Table I. Portable maintenance shelter components.

<u>Component</u>	<u>Quantity</u>	<u>Component</u>	<u>Quantity</u>
<u>Frame</u>		<u>Electrical Harness</u>	
Skids	2	Assembly 1 (distribution	
Columns	14	panel, 3 outlet boxes,	
Roof arch	7	2 outlet boxes for	
Purlins	90	lamps, and prewired	
Skirts	12	conduit)	1
Turnbuckles (10-foot)	16	Assembly 2 (8-foot	
Bolts, 1/2" $\emptyset$ x 1-1/2"	350	section of prewired	
<u>Towing Supports</u>		conduit and 1 outlet	
Spreader bar	2	box)	3
Turnbuckle rods	2	Assembly 3 (8-foot	
<u>Cover</u>		section of prewired	
Hook bolts	16	conduit and 1 outlet	
Turnbuckles	8	box for a light	
Cables	8	fixture)	4
Right end cover	2	Light fixture	6
Left end cover	2	Wire connectors	3 doz.
Gable cover	2	<u>Side Entry</u>	
Roof cover "A"	5	Panel	1
Roof cover "B"	1	Bolts, 1/2" $\emptyset$ x 1-1/2"	24
Belly bands	7		
<u>End Struts</u>	2		



Figure 1. The portable maintenance shelter.

## SITE PREPARATION

The site for erection of the maintenance shelter must be smooth and level before construction begins. Unevenness in the relative positions of the two skids will cause difficulty in making bolted connections. Visual observation is sufficient for grading the area. Surveying accuracy is not required.

## PALLET FLOOR

The maintenance shelter is packaged in pallet-type flooring (Figure 2). These pallets, which form the top and bottom of the packing crates, make a floor 18 feet wide by 27 feet long.

## FRAME

The frame is erected on two skids placed 18 feet apart, with the track toward the center.

The arch ribs are shipped in three pieces. Each rib consists of two columns and one arch which are bolted together through connecting plates welded to the web of the arches. To erect, bolt the 3-piece arch ribs together, being careful to match bolt holes with the skid system. The base of the column has eight bolt holes on the outside and six bolt holes on the inner face. The top of the column has three holes in the web and two holes on the inner face.

After all arch ribs have been assembled, place the first rib in an upright position at the end of the skids (Figure 3), and insert the web of the columns into the slots on the outer edge of the skids (Figure 4). Bolt the columns to the skids and brace them until the next rib is in place. Erect the next rib in the same manner. Connect the two ribs by placing fifteen purlins in the cleats between arch ribs (Figure 5), and bolt the skirt panels to the column flanges and outer edge of skids. Continue by erecting the following arch rib, then inserting the purlins and bolting the skirt panels to the columns until all of the frame is completed.

Next, insert the 10-foot turnbuckle rods diagonally between columns in the end bays (Figure 6). The two 31-foot turnbuckle rods and the two 4-inch-diameter by 18-foot-long spreader bars should be secured to the frame of the shelter after it is erected. They are used to brace the shelter for moving (see TOWING).

## COVER

The end covers must be installed first. Each end has right and left curtains which slide horizontally on cables stretched between columns at the top and bottom of the opening (Figure 7). The right curtain slides on the outer cable and overlaps the left curtain at the center.

To install cover, bolt 2 hook bolts (Figure 8) to the inner face of each end column, 10 inches above the base, and 3 inches above the splice between the arch and the column. String cable "A" with turn-buckle between each pair of opposite hooks, and tighten.

Next, attach the right end cover to the outer upper and lower cables by fastening harness snaps on the cover to the cables; lettering on the cover must face outside. Tie the right edge of the cover to the right column with the tie straps provided. Attach the snaps on the left cover to the inner set of cables and tie the left edge of the cover to the left column. Tie the gable cover to the arch with the tie straps and let it overlap the right and left end covers. Repeat the above procedure for installing covers in the opposite end of the shelter.

After the end covers are installed, place a roof cover "A" over an end bay of the structure with the edge of the blanket containing the tie straps overlapping the end cover. Insert the straps through the corresponding slots in the end covers and secure them by buckling around the arch rib. Place another roof cover "A" over the next bay with the edge containing the straps overlapping the first roof cover and secure it with tie straps (Figure 9) in the same manner as the first one. Tighten the first cover by hooking the straps at the ends of the cover into the holes provided in the skirt panels and take up all slack (Figure 10). Insert the ropes at the edges of the cover through the eyebolts in the skid, pull the rope tight, and secure it. Repeat this procedure for each roof cover "A". The final roof cover is marked "B", and is placed over an end bay overlapping both the end cover and the adjacent roof cover. Roof cover "B" contains tie straps in both edges for securing it to the arch ribs. After all of the cover has been installed, retighten all straps. Place a belly band over each arch and secure the straps at each end of the bands to holes in the skirt panel. Tie the guy ropes on each belly band to deadmen or stakes. When the shelter is heated, all ropes and straps should be retightened after the cover is warm.

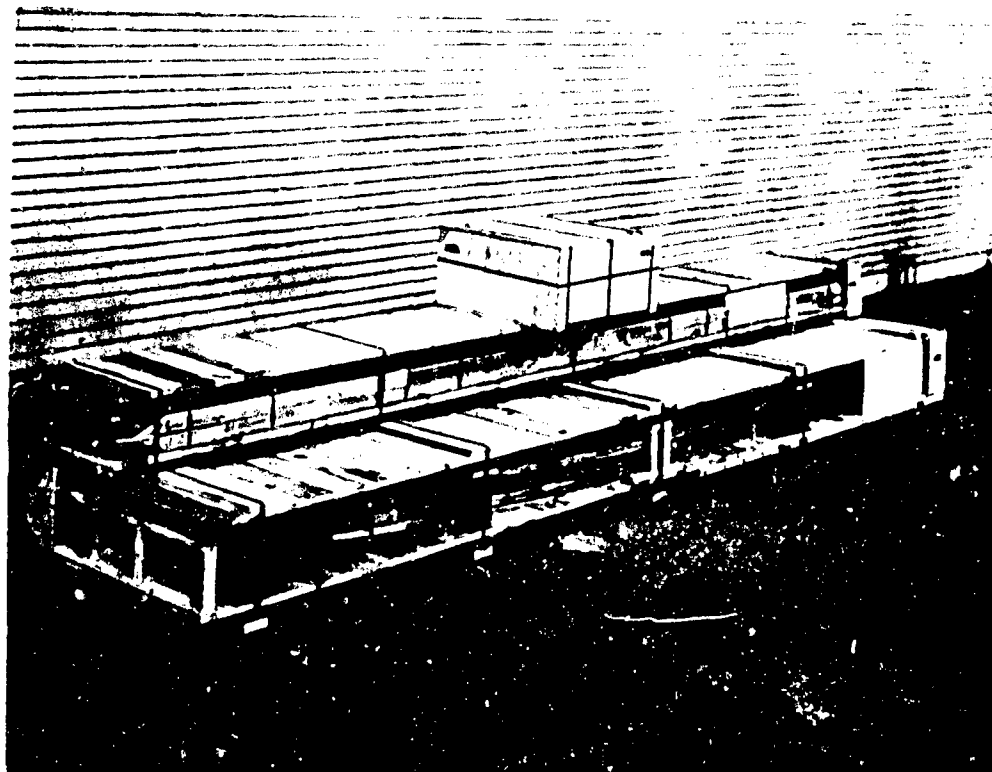


Figure 2. Shelter frame and cover packaged in pallet-type flooring.

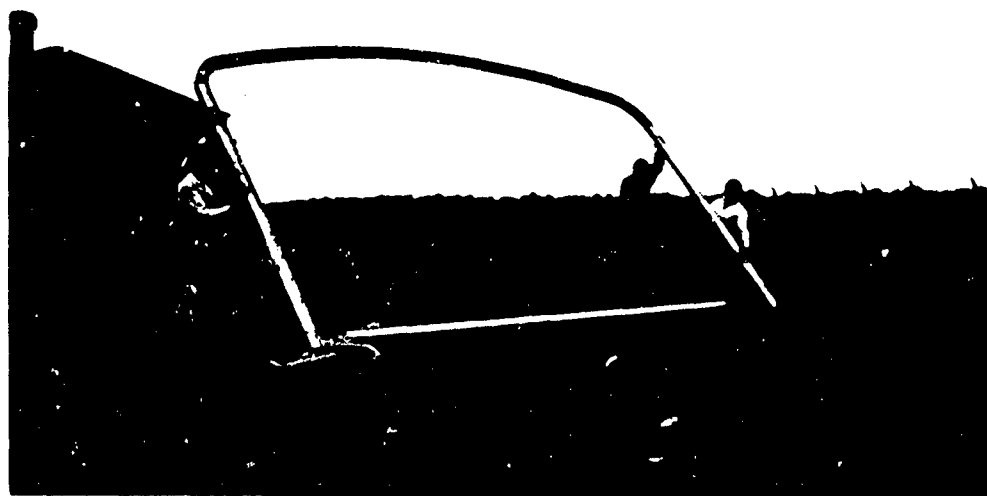


Figure 3. Erection of an arch rib.





Figure 4. Bolting a column to the skid.



Figure 5. Installing the purlins.

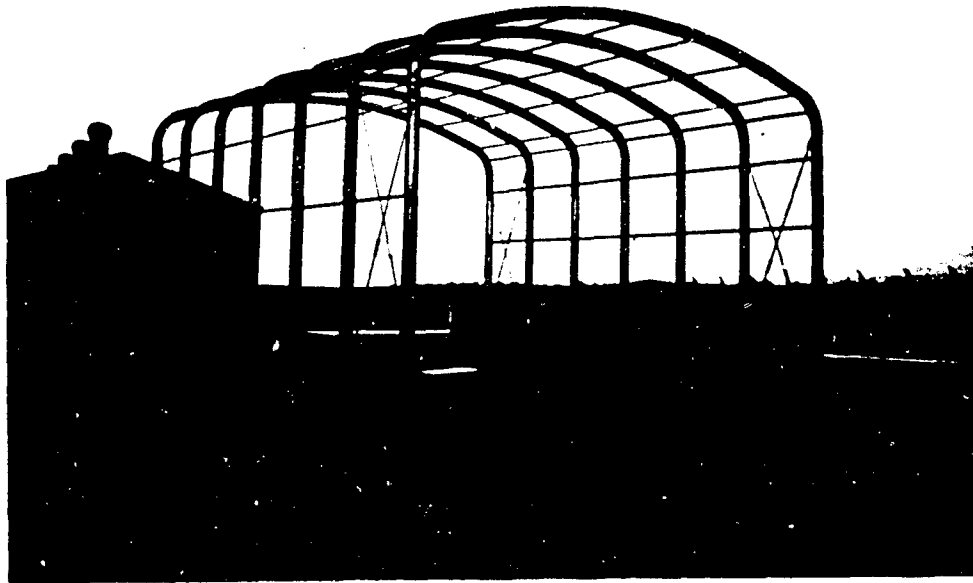


Figure 6. The shelter frame.

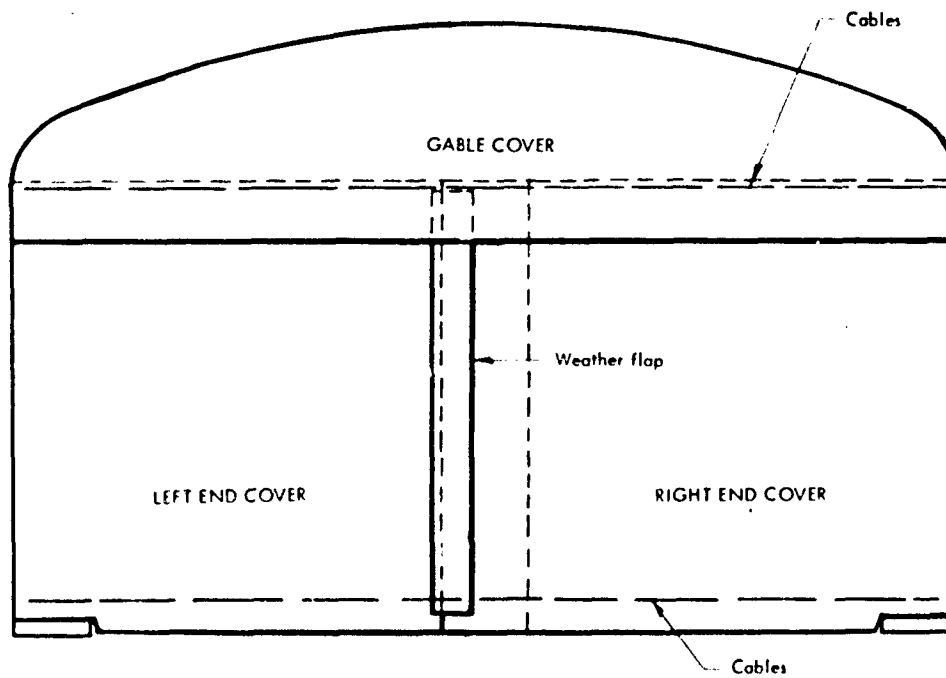


Figure 7. Arrangement of the end covers.

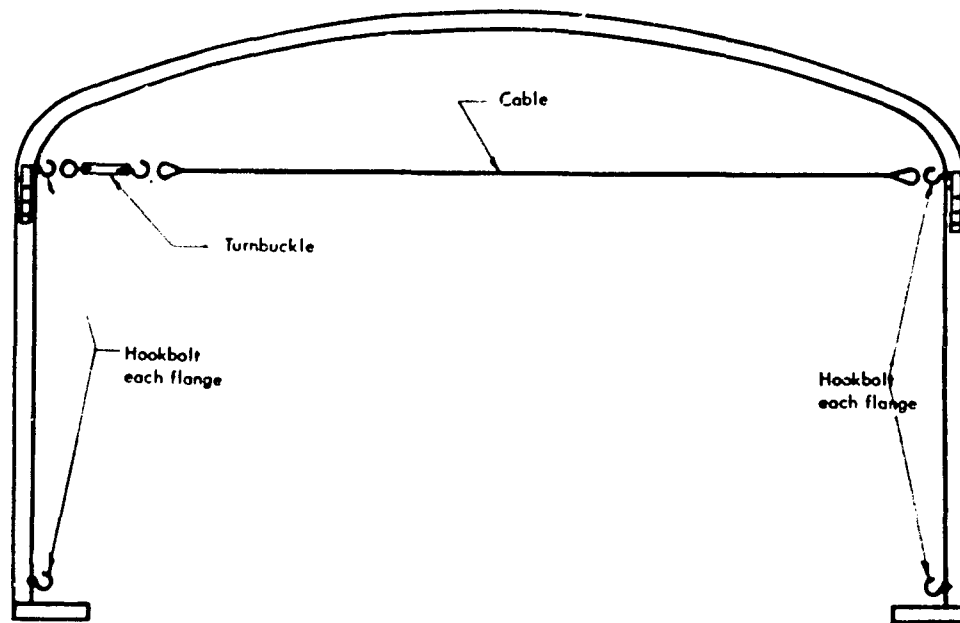


Figure 8. Cable assembly for end cover.



Figure 9. Tie straps on covers.



Figure 10. Securing a cover to the skirt.

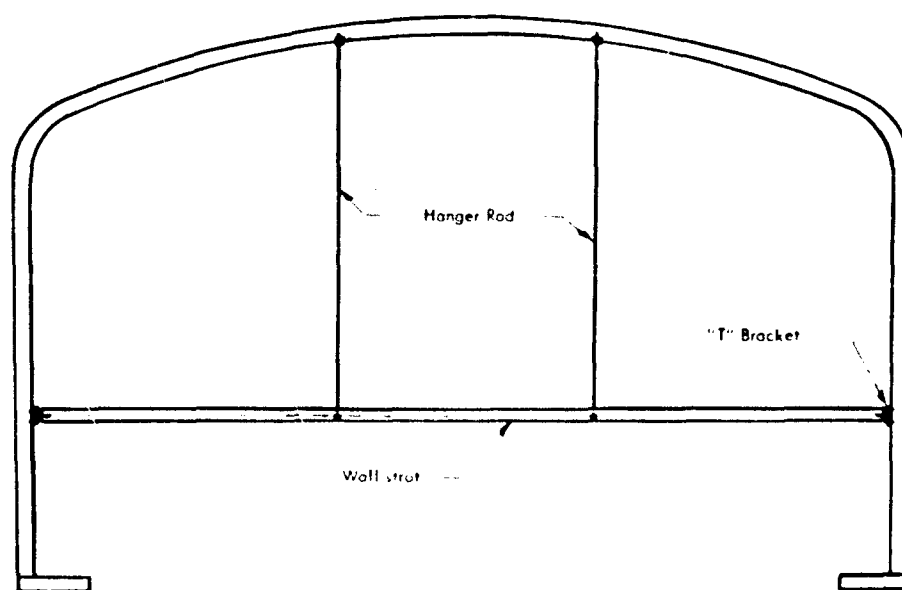


Figure 11. Arrangement of the end wall strut.

## END STRUTS

Removable struts are provided to prevent excessive deflection of end covers due to wind. These struts are 20-foot-long aluminum beams supported at each end by T-section brackets (Figure 11). To erect, bolt a bracket to the inner face of each end column through the four holes provided 4 feet 3 inches above the base. The protruding section of the "T" should be horizontal. Place the struts on the brackets and bolt each end. If end covers are opened frequently, leave struts unbolted.

If the struts are to be left permanently in place, support the third points of the struts with the 1/2-inch-diameter by 9-foot-long hanger rods by inserting the rods into holes in the strut and the flange of the arch and putting nuts on both ends.

## TRAVELING HOIST

The 2-ton hoist travels on an aluminum "I" beam which spans the width of the shelter. This beam is supported by an "A" frame, fitted with wheels, which travels on tracks on the inside edges of the skids. For detailed assembly instructions, see the manufacturer's literature packaged with the hoist.

## SIDE ENTRY

The side entry is a 1-inch plywood panel, 4 feet wide by 6 feet 9-1/4 inches high, containing a door. The panel may be installed anywhere along the side of the building except in an end bay.

If installation is to be made in an erected building, loosen the belly band straps over the columns to which the panel will be bolted. Loosen straps and ropes on the end of the roof blanket where the panel will be located and untie the first 4 tie straps on both columns. Remove the skirt panel.

Next, place the side-entry panel against the outer face of the columns and the skid. The door should open into the building. Align the panel to match bolt holes with the columns and skid, and bolt in place. Cut the roof cover, leaving a 3-inch lap over the top of the panel and nail the edge to the panel. Pull the overlap from the two adjacent roof covers over the sides of the side-entry panel and nail to the panel. Fasten straps at the end of the belly bands and tighten.

## ELECTRICAL HARNESS

The electrical harness for the shelter consists of a distribution panel and five circuits. All wiring is contained in conduit cut to length. Rigid conduit is used for lines parallel to the sides of the shelter; flexible conduit is used for the overhead line across the shelter. The harness provides for six overhead lights and six convenience outlets (Figure 12). Each convenience outlet contains a 120-volt duplex receptable and a 240-volt twist-lock receptacle.

Assembly 1 includes the distribution panel, convenience outlet boxes attached to this panel with 4-foot lengths of rigid conduit, and a flexible conduit fitted with two boxes containing lamp bases and one box containing convenience outlets. The flexible conduit is attached to one of the boxes on the rigid conduit. This flexible line goes across the top of shelter at the middle arch rib.

To erect, lay out this assembly on the floor with the flexible conduit directly under the middle arch (Figure 12). Mount the distribution panel and adjacent outlet boxes on the columns with the conduit 6 feet 7 inches above the skid. Attach the panel and boxes to columns with spring clip mounting brackets. Attach the flexible conduit overhead to the middle arch rib, locating the boxes containing the lamp bases about 5 feet in from each side of the shelter. Attach the end box containing the convenience outlets on the opposite column 6 feet 7 inches above the skid. Secure the boxes with spring clip mounting brackets. Also attach the flexible conduit to the arch rib with conduit hangers.

Assembly 2 consists of three 8-foot-long, prewired, rigid conduit sections fitted with boxes containing convenience outlets. Attach these sections to Assembly 1 as shown in Figure 12. This will place the convenience outlets 6 feet 7 inches above the skids and 4 feet from the ends of the building. Connect the conduit to the wall boxes on Assembly 1 with compression fittings and connect the wires with wire connectors, being careful to match wire colors. Secure the boxes on the ends of the conduit sections to the columns with spring clip mounting brackets.

Assembly 3 consists of four 8-foot-long, prewired, rigid conduit sections with boxes fitted with lamp bases. Attach these sections to Assembly 1 as shown in Figure 12. This will place the lamp bases overhead 5 feet in from the sides of the shelter and 4 feet from the ends. Connect the boxes on Assembly 1 with compression fittings and connect all wires with wire connectors, being careful to match colors. Secure the boxes on the ends of the conduit sections to the arch ribs with spring clip mounting brackets. When Assembly 3 is installed, hang the six overhead lamps.

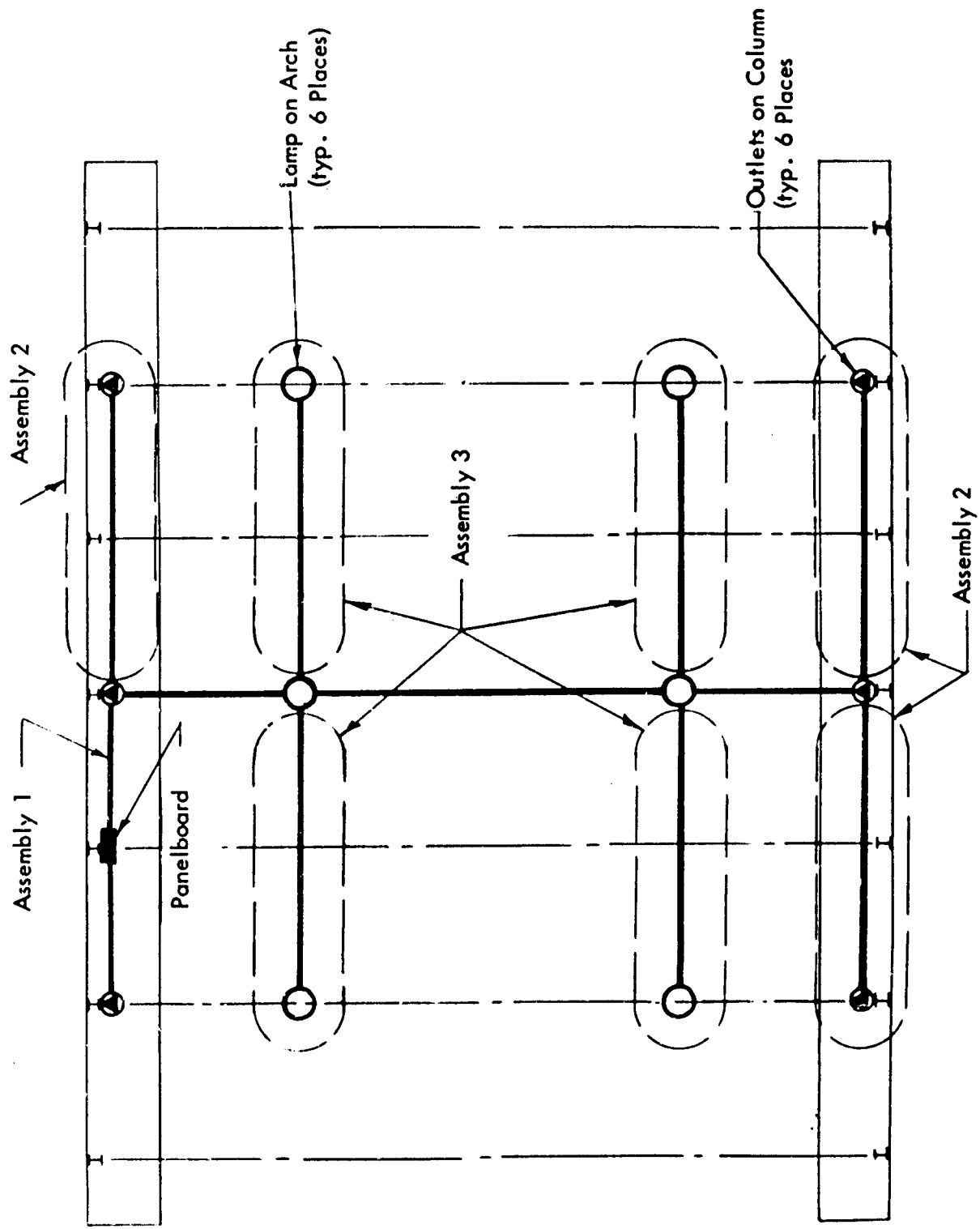


Figure 12. Layout of the electrical harness for the shelter.



## HEAT AND POWER

No heat or power is provided for the portable maintenance shelter. The shelter is designed for heating with a portable fresh-air heater. A zippered flap is provided in the side of the shelter for delivery of this heat through a flexible duct. A 110/220-volt single-phase power source of 2.5-kw capacity is required for the shelter.

The heat and power requirements for the shelter and its companion, the equipment-repair wanigan, can be satisfied easily with the utility service sled described in NCEL Technical Report R-276. This unit consists of a gasoline-engine-driven 8.75-kw electrical generator, a gasoline-engine-driven 400,000-Btuh fresh-air heater, a 180-ampere arc welder, and a portable oxyacetylene cutting outfit mounted on a sled. Wire must be provided for connecting the generator to the distribution panel.

## TOWING

To move the assembled shelter, place the 18-foot spreader bar across each end of the shelter, (see FRAME), inserting the pins at the ends of the spreader bars into the inside holes in the ends of the skids (Figure 13). Place the 31-foot turnbuckle rods diagonally between skids, inserting the pins at the ends of the rods into the outside holes in the ends of the skids (Figure 13). Tighten both turnbuckles. No drawbar is provided with the shelter. Steel straps attached to the ends of the skids can be used for this purpose.

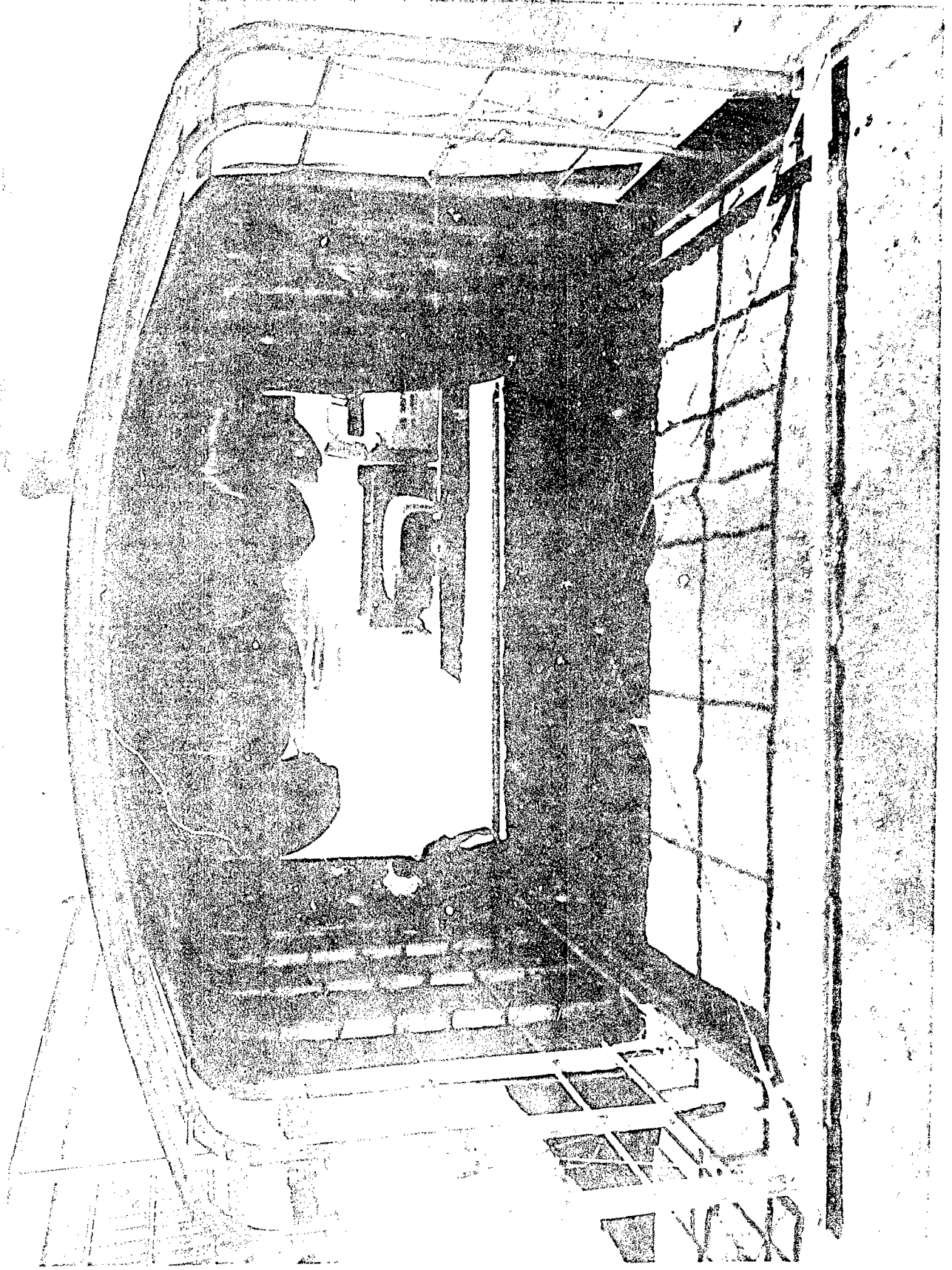


Figure 13. Spreader bars and cross-bracing for towing

## PART II. EQUIPMENT-REPAIR WANIGAN

### GENERAL DESCRIPTION

The 8- by 20-foot equipment-repair wanigan (Figures 14 and 15) includes:

1. A skid-mounted floor.
2. Prefabricated wall and roof panels.
3. An electrical harness for general lighting and power.
4. A space heater with an electric blower and a fuel tank.

The summary of the wanigan components is given in Table II.

### SKID-MOUNTED FLOOR

The floor consists of two skids with cross members at 3-foot 11-inch spacing, supporting five 3-foot 8-1/2-inch by 7-foot 6-1/2-inch floor panels.

To erect, place two 10-foot-long skid sections with splice plates on one end on a level area parallel to each other and 5 feet 9 inches apart on centers. Place two 3 by 6 cross members across the skids in the notches provided 2 feet and 6 feet from the splice end of the skids (Figure 16). Align the bolt holes in the cross members with those in the bent bar beside each notch, and secure with 7/8- by 4-3/4-inch bolts. Place a 3 by 8 cross member across the skids in the notch at the end fitted for the tongue. Align the holes in the cross members with the holes in the bent bar on each side of the notch and bolt with 7/8- by 4-3/4-inch bolts. Two 2 by 8's have splice plates on one end. Place one of these on each side of the cross members with the splice plates on the outside. These splice plates must fall over the splice plates on the skids. Bolt the 2 by 8's to the connecting angles on each end of the cross members with 1/2- by 1-1/2-inch bolts.

Table II. Wanigan components.

<u>Component</u>	<u>Quantity</u>	<u>Component</u>	<u>Quantity</u>
<u>Skid-mounted floor</u>		<u>Walls and roof</u>	
Skid system (sections)	2	MK-4 wall panels	4
Floor panels	5	MK-5 wall panels	2
Angle iron plates	4	MK-6 wall panels	4
Floor cover plates	4	MK-22 roof panels	1
Tow bar	1	MK-23 roof panels	3
Splice plates	2	MK-24 roof panels	1
Bolts, 3/8" x 1-1/2"		MK-25 end-wall panels	2
Countersink	32	MK-26 end-wall panels	2
Bolts, 3/8" x 1"	4	MK-27 end-wall panels	2
Bolts, 3/4" x 4-1/2"	12	MK-20 end door panels	2
Bolts, carriage,		MK-21 end door panels	2
1/2" x 2-1/2"	20	MK-7 gusset plates	8
Screws, lag,		Plate washers	272
3/8" x 2-1/2"	8	Bolts, 3/8" x 3"	82
Nuts, 3/8" NC		Bolts, 3/8" x 3-1/2"	72
Hex head	48	Bolts, 3/8" x 4"	14
		Bolts, 3/8" & 4-1/2"	14
		Nuts, wing, 3/8"	7
		Nuts, 3/8" NC Hex head	72
<u>Electrical Harness</u>		<u>Heating System</u>	
4-circuit junction		Space heater	1
box	1	Side-mounted fuel tank	1
4" sq. boxes	5	Roof jack	1
2" x 4" handy boxes	5	Vent pipe	1
3" boxes	3		
Duplex outlets	10		
2 pole single throw			
switch	4		
Light outlets	3		
Waterproof outlet boxes			
with outlets and			
watertight covers	4		

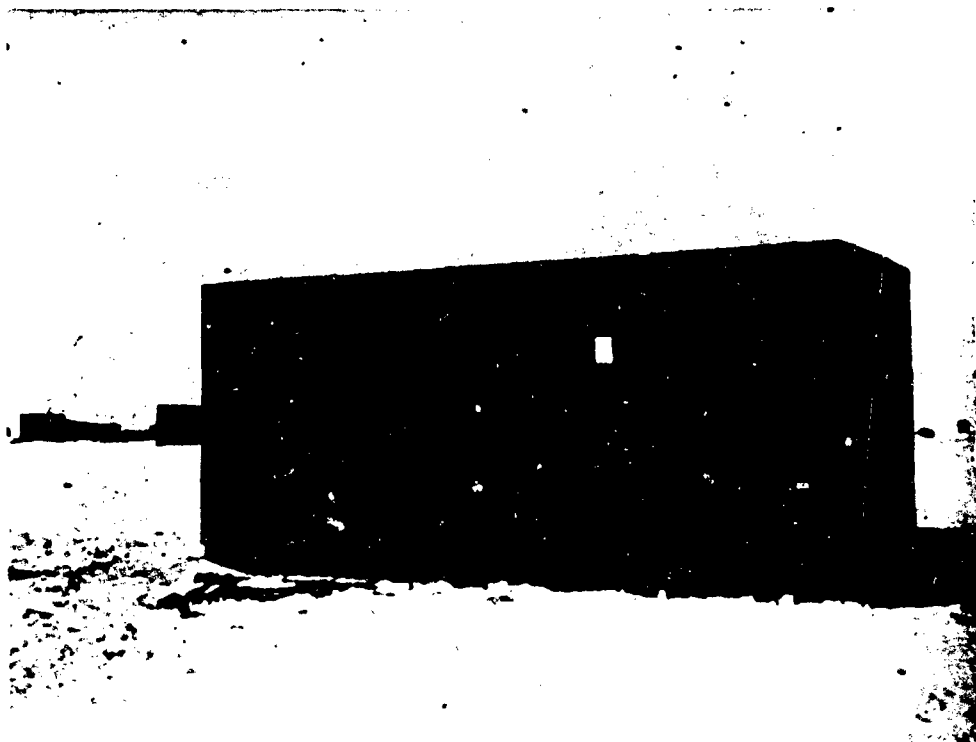


Figure 14. The equipment-repair wanigan.

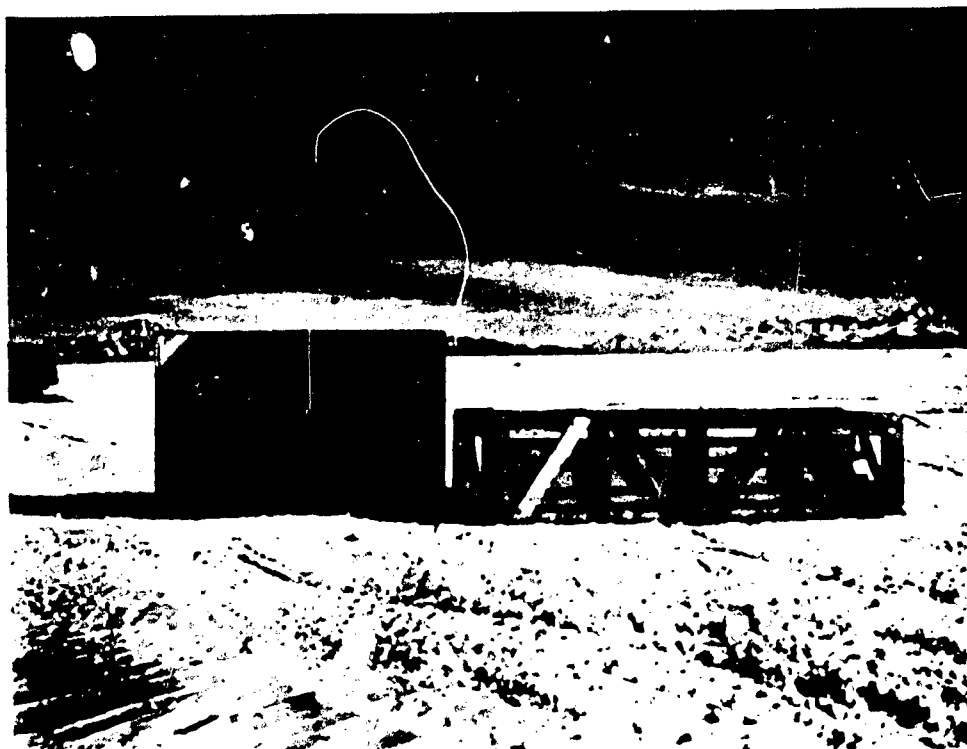


Figure 15. Equipment-repair wanigan packaged for shipment.

Repeat the above procedure for the other half of the skid system. Assembly of this section is identical to the first section except it has no splice plates.

The two sections of the skid are joined at the center. Butt the splice ends of the two sections together (Figure 17), align the holes in the skids with the holes in splice plate on the bottom of the skids, insert 3/8- by 1-1/2-inch countersunk bolts from the bottom up and secure with nuts. Use 3/8- by 1-inch bolts for the holes in the "V". Secure the splice plates near the top of the skid with 3/4- by 4-1/2-inch bolts through the skid and both plates. Secure the splice of the 2 by 8 timbers along each side of the frame with 1/2- by 2-1/2-inch bolts through the side of the timber, and 3/8- by 2-1/2-inch lag screws in the top.

Place a floor panel in each bay of the skid system with the smooth face up (Figure 18). The 2-1/2- by 1-1/2-inch angles, 9 feet 8 inches long, are used to secure the floor to the skid system. Place two angles along each side of the floor with the 2-1/2-inch leg on the floor and the 1-1/2-inch leg against the frame (Figure 19). The plate welded on the end of the angle must be against one end of the frame. Bolt the angles to the floor with 1/2- by 3-1/2-inch bolts. Use 1/2- by 2-1/2-inch carriage bolts to secure the angles to the 2 by 8 timbers along each side of the frame. Bolt only through the holes near the corners of the floor panels leaving the two intermediate holes free for bolting on the wall panels.

Place one 4-inch-wide by 7-foot 1-inch-long sheetmetal strip (Figure 19) over each cross member and secure each one with six 1/4- by 2-1/2-inch lag screws through the holes provided in the sheetmetal strip.

## WALLS AND ROOF

Begin erecting the wall panels at one corner using Figure 20 as a guide. All wall panels are bolted with 3/8- by 4-1/2-inch bolts to the outer face of the 2 by 8's around the perimeter of the skid system. Panels are installed with the orange face on the outside. Identification marks are at the top of the wall panels.

Bolt an MK-26 panel to the end of the frame with the right edge of the panel at the corner. Bolt an MK-5 panel to the side of the frame, forming a corner with the MK-26 panel. Bolt the two panels together using 3/8- by 3-1/2-inch bolts. Bolt an MK-25 panel to the same end at the opposite corner of the frame and use another MK-5 panel on the side, forming another corner of the wall. Place an MK-27 panel across the top of the end wall; bolt it to the end-wall panels with 3/8- by 3-inch bolts and to the MK-5 panels with 3/8- by 3-1/2-inch bolts. Place roof panel MK-24 on top of the wall panels spanning the width of the wanigan. Use 3/8- by 3-1/2-inch bolts to bolt the roof panel to the MK-5 panels and the first two holes at each end of the MK-27 panel. The center bolt holes require 3/8- by 4-inch bolts.

Continue erecting wall panels using MK-4 panels on the right side and MK-6 panels on the left side. Always leave the top two bolts out as knee braces are installed there after the panel assembly is completed. After erecting the wall panels for each bay, place a roof panel MK-23 with the ends resting on the wall panels and secure with 3/8- by 3-1/2-inch bolts. Use 3/8- by 4-inch bolts in the two center holes along the edge of the roof panel to bolt it to the adjacent roof panel. Leave the two outer bolts on each end out of the lap joint as these are also used to secure the knee braces.

Continue placing roof and wall panels in the same manner to the end of the wanigan. The only deviation is the use of an MK-22 roof panel in the end bay. The end-wall panels are erected in the same manner as the opposite end.

Place an MK-7 gusset in the top corner at each lap joint along the side walls (Figure 21). Bolt the gussets to the side and roof panels with 3/8- by 3-1/2-inch bolts.

Install door panels MK-20 and MK-21 in both end walls by attaching the hinges on the doors to the adjacent wall panels with 1/4- by 4-1/2-inch bolts. Secure the MK-20 doors at the top with 3/8- by 3-inch bolts and at the bottom with 3/8- by 4-1.2-inch bolts, using wing nuts for easy removal.

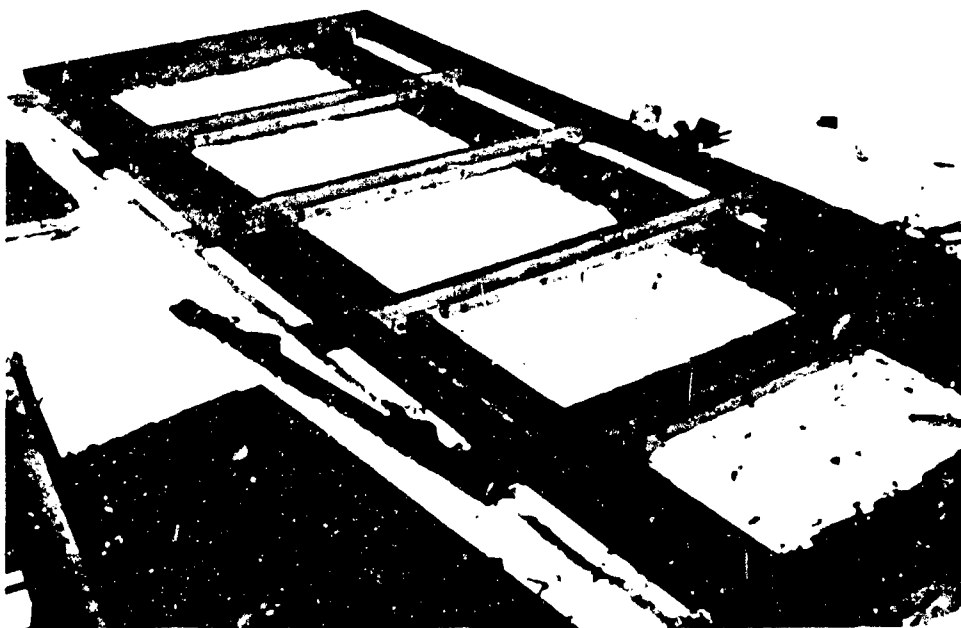


Figure 16. Skid system frame.



Figure 17. Center splice for skid system.



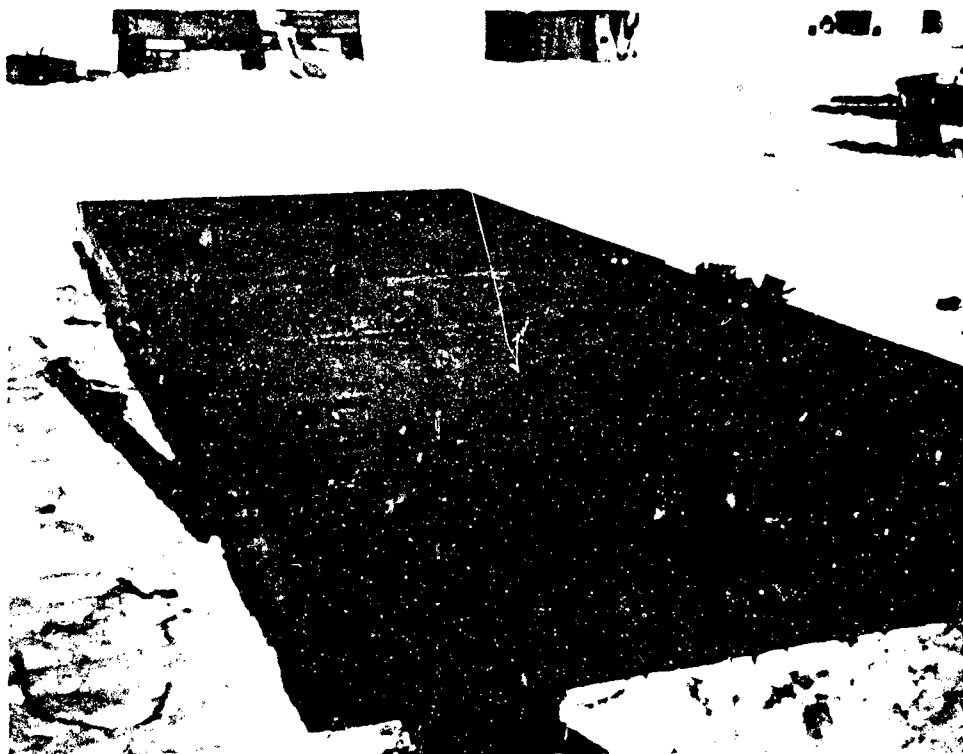


Figure 18. The skid-mounted floor.

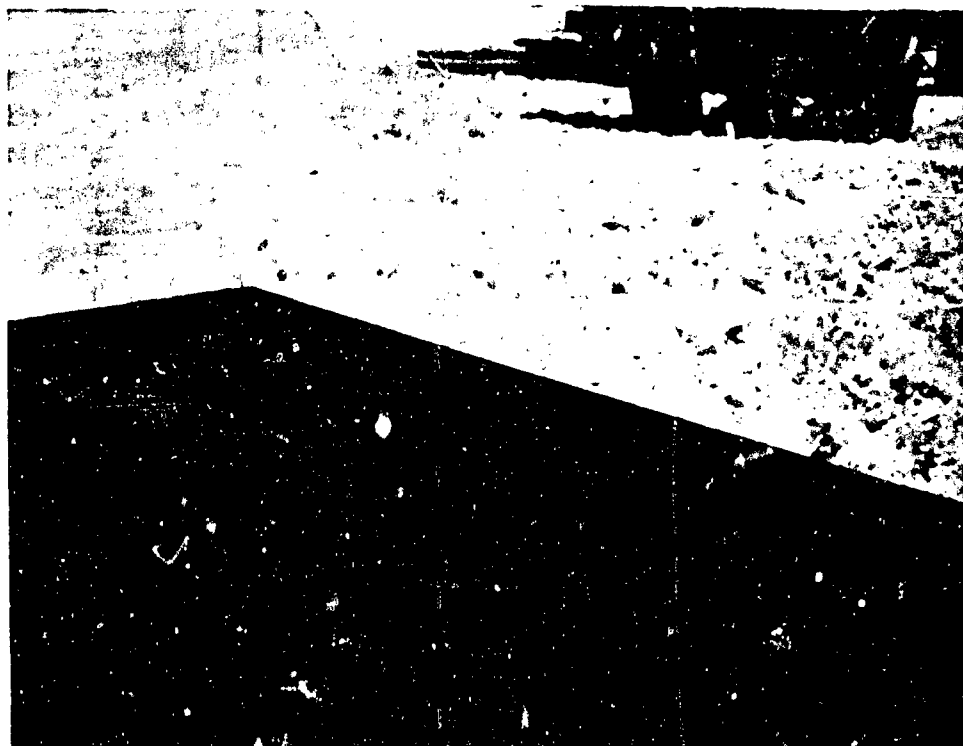


Figure 19. Hold-down angle and metal strip.

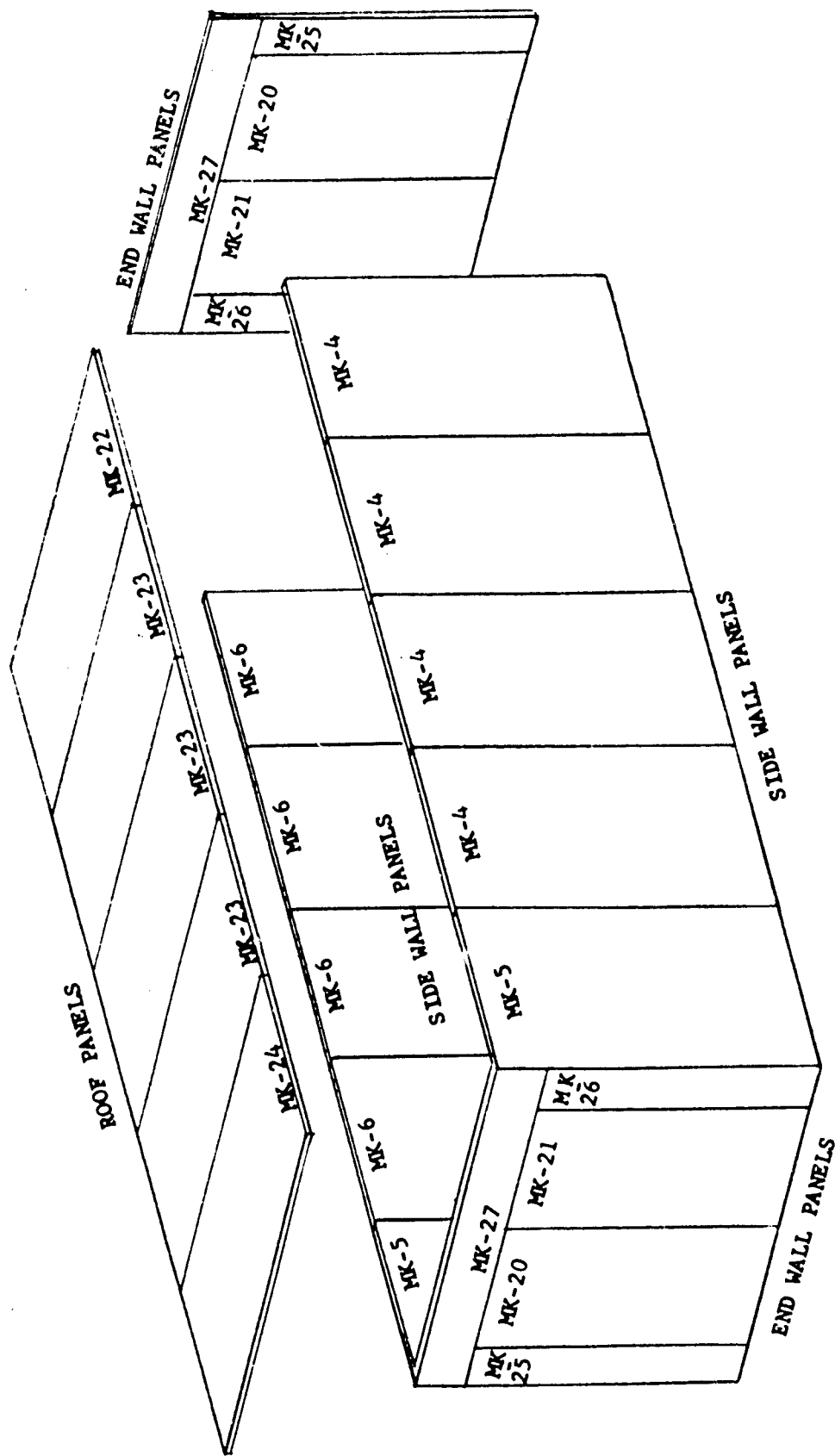


Figure 20. Exploded view of floor and roof panels.

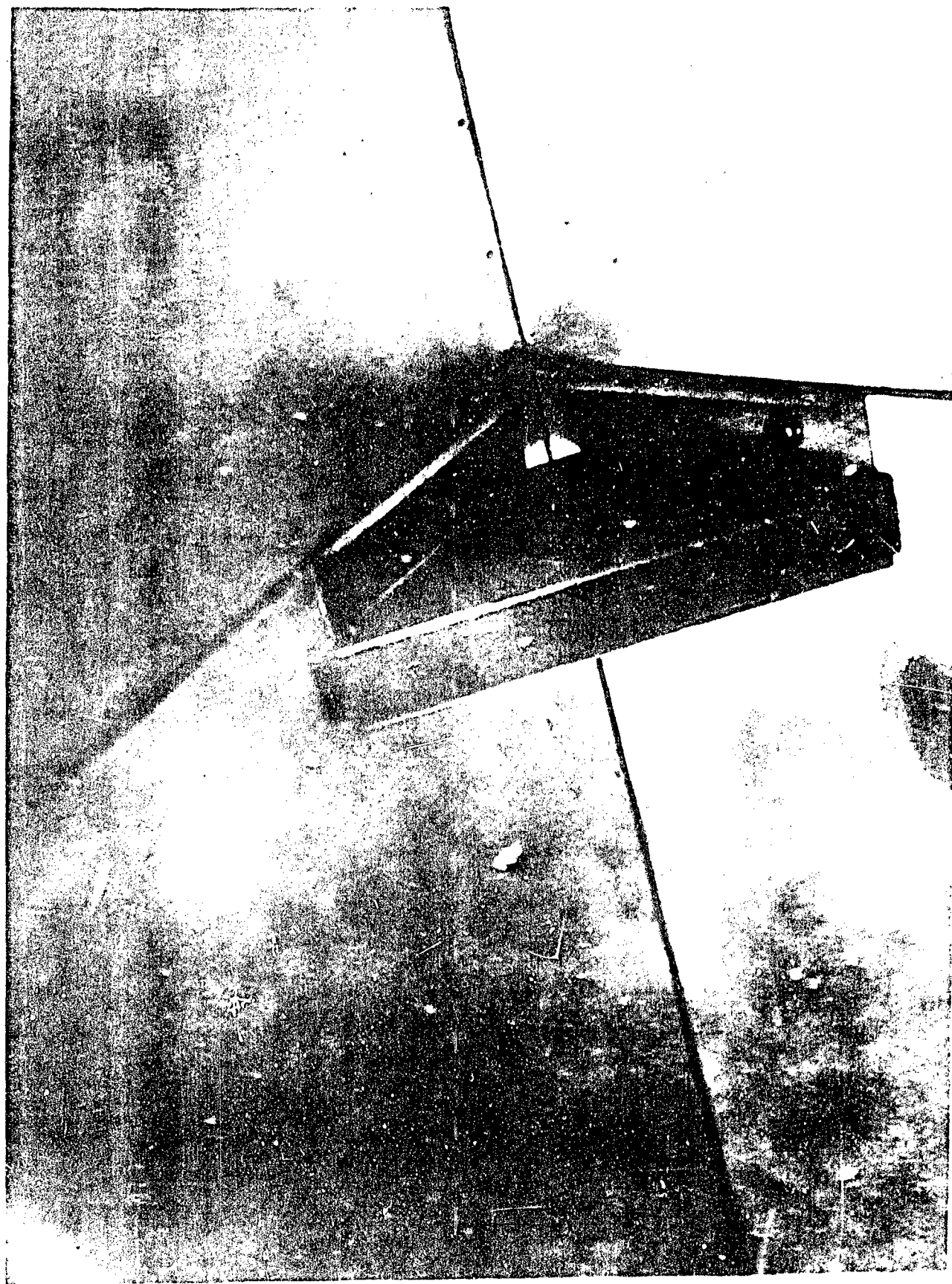


Figure 21. An MK-7 gusset bolted in place.

## **ELECTRICAL HARNESS**

The electrical harness consists of a 4-circuit breaker panel and plastic-jacketed cables cut to length and wired into convenience outlets and light fixtures. A 3-prong twist-lock connector on the outside of the wanigan is provided for connecting the harness to a power source. The electrical layout is shown in Figure 22. There are three lights with reflectors on the longitudinal center of the ceiling, four 15-ampere duplex outlets spaced along each interior side wall, and two watertight outlets on each exterior side wall. Outlets and fixtures are attached to the walls and ceiling with wood screws.

To erect, mount the circuit breaker panel 4 feet above the floor at the center of either side wall. Mount the light fixtures along the longitudinal center of the ceiling. Locate them 4 feet from each end wall and at the center of the wanigan. Use wire clamps to attach the wire to roof and wall panels. Connect the wires from the center light into the circuit breaker panel, attaching the white wire to the neutral bar and the black wire to a breaker.

Wire one circuit containing four duplex outlets into the circuit breaker panel in the same manner as the light fixture circuit was wired. Place the duplex outlets along the wall 4 feet above the floor. The spacing is governed by the length of pre-cut wire. The other circuit with four duplex outlets has a wire to go up the side, across the ceiling and down the other side. Connect this wire into the junction box, and mount the duplex outlets 4 feet above the floor along the opposite side of the wanigan.

Drill a 1/2-inch hole through the wall panels at the center of the outlet boxes located near the corners of the wanigan. Mount a watertight outlet box over each hole and connect wires to the wires in the interior box, matching wire colors.

## **POWER**

An electrical generator is not provided with the wanigan. A 110-volt, single-phase power source of 2.5-kw capacity is required. The utility service sled described under HEAT AND POWER in Part I can be used to satisfy the power requirements for both the maintenance shelter and the wanigan.

## HEATING SYSTEM

The heating system consists of a 27,000-Btu/h space heater, vent pipe, fuel line and an 80-gallon side-mounted fuel tank.

Place the heater at the center of the wanigan near one side wall. Cut a 6-inch-diameter hole in the roof directly above the heater vent. Screw the sheetmetal collar to the top of the roof panel centered above the hole. Insert the vent pipe down through the collar and mount it on the heater.

Bolt the fuel tank to the side of the wanigan adjacent to the heater, using the same bolts as are used to connect wall panels to each other. Drill a hole through a wall panel for the fuel line.

## OUTFITTING

Outfitting for the equipment-repair wanigan includes:

1. Two cabinet-type work benches.
2. Storage bins, tool chests, a tool cabinet, and a tool cart.
3. A grinder, portable air compressor, lubricating unit, and torch outfit.
4. Shop and hand tools.

A detailed list of equipment and tools for the wanigan is given in Table III.

After the wanigan is completely assembled and the electrical harness and heater are installed, install the equipment as shown in Figures 23, 24, and 25. Assemble the knocked-down items in accordance with the manufacturer's instructions packaged with the equipment. Store the tools and other small items in the spaces provided.

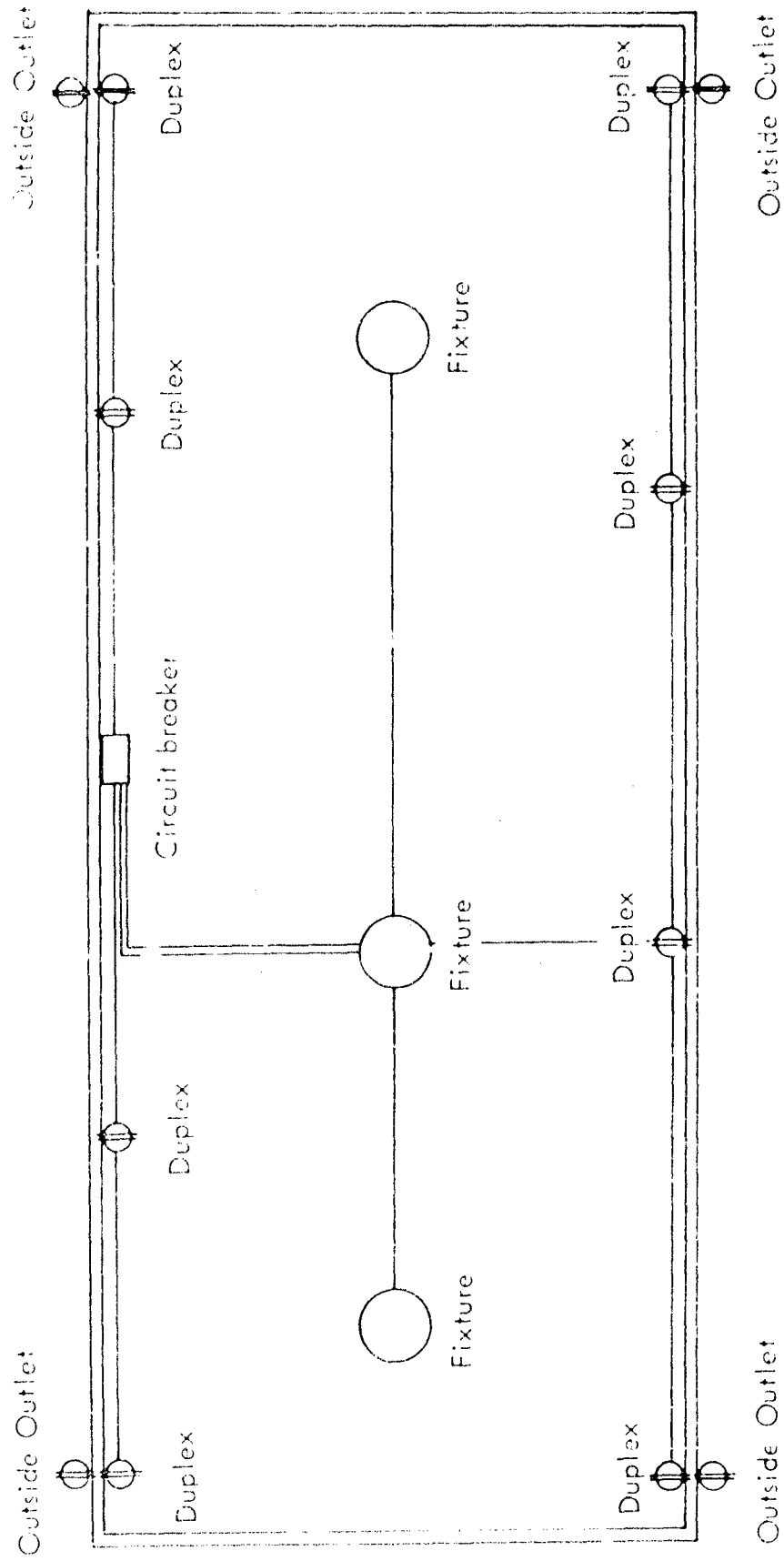


Figure 22. Layout of the electrical harness for the wagon.

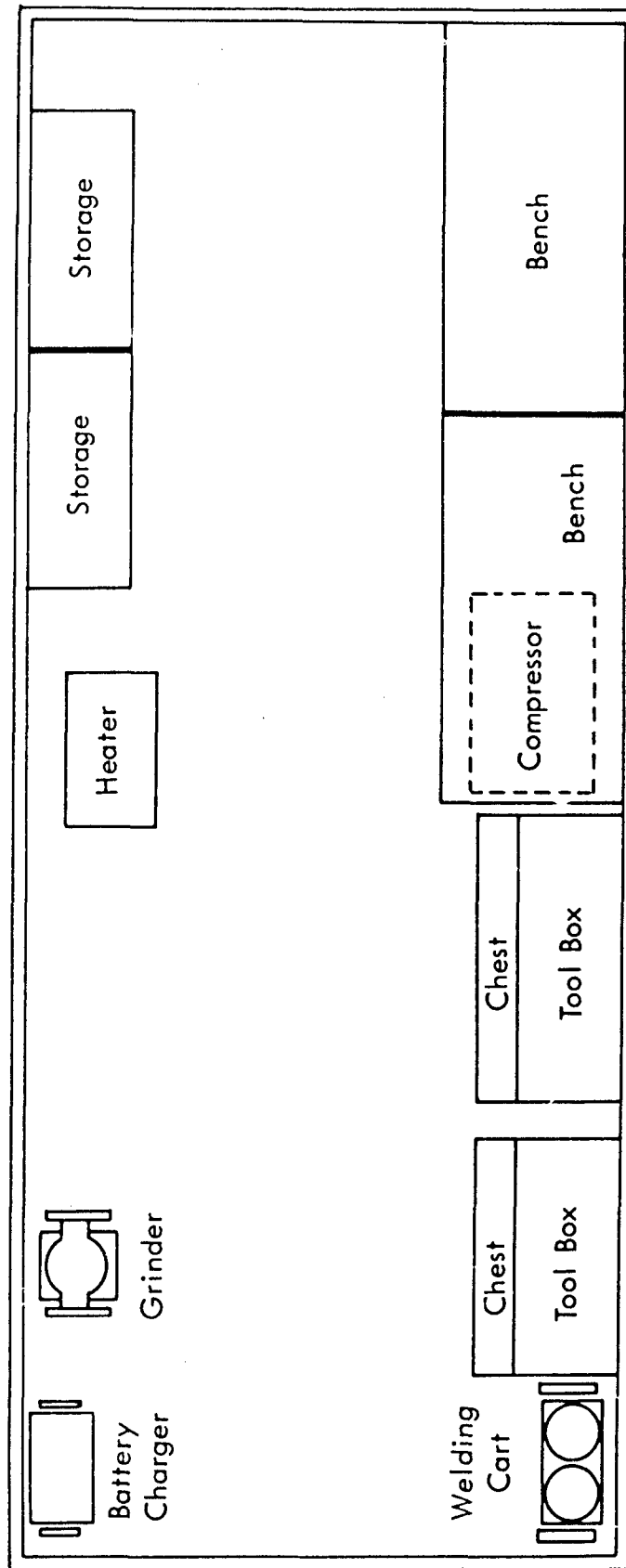


Figure 23. Layout of equipment in the wagon.

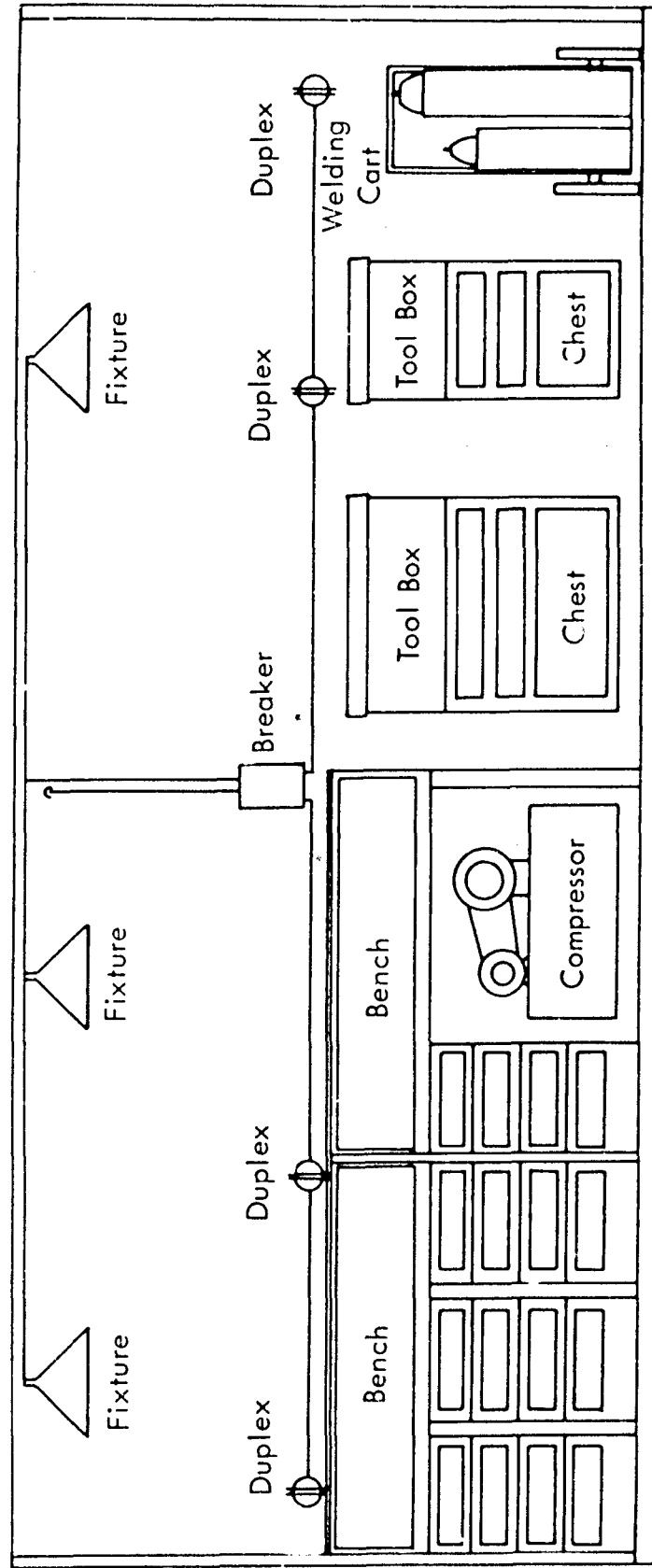


Figure 24. Arrangement of work benches and tool chests in wanigan.



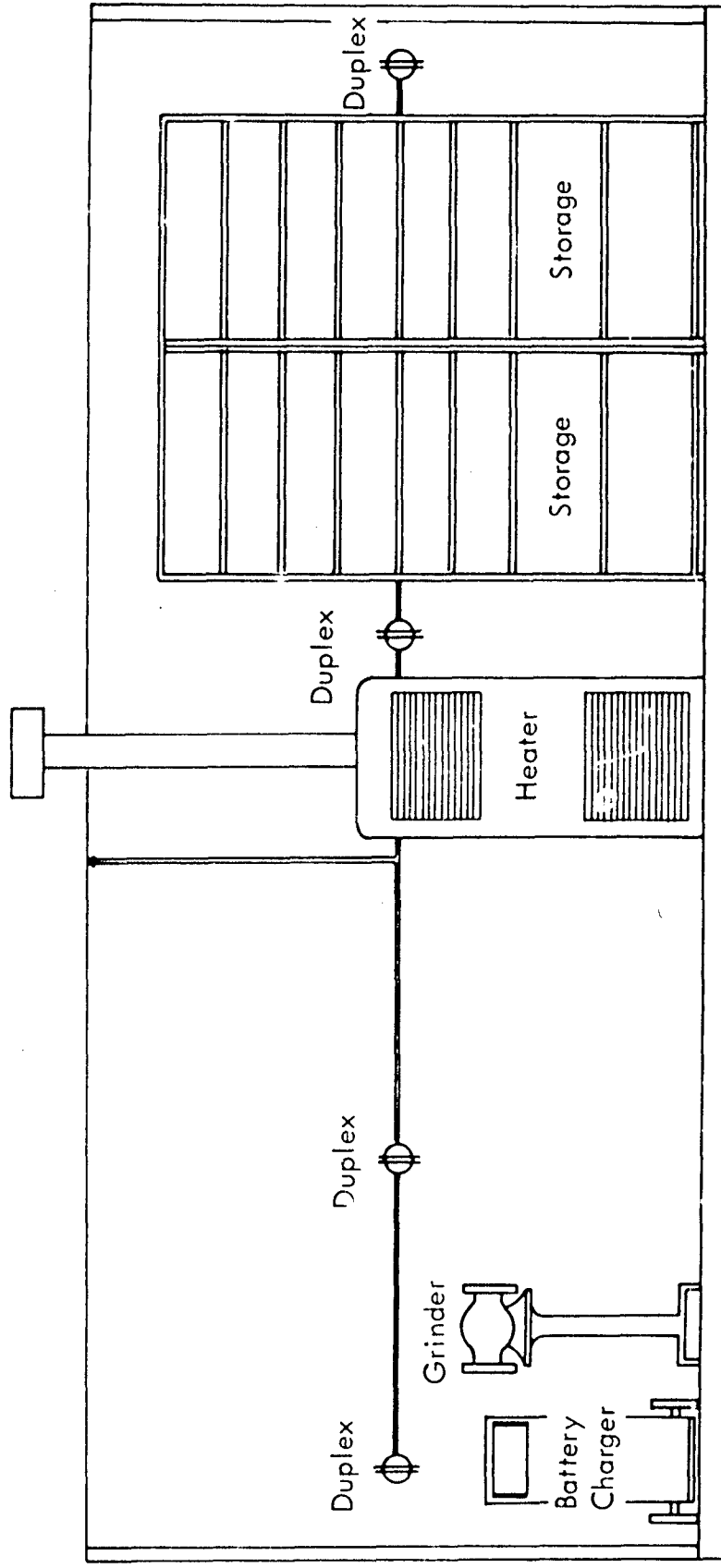


Figure 25. Arrangement of equipment, heater and storage bins in wanigan.

Table III. Equipment and tools for equipment repair wanigan.

### Fixed Equipment

Two work benches, cabinet type, 72" x 29" x 32"  
 Two storage bins, 8 compartment, 81-1/2" x 30-1/2" x 18-3/4"  
 One vice, machinist  
 One grinder, heavy-duty, pedestal-mounted, electric-driven, with adjustable eye shields; one coarse and one medium wheel, 1/3 hp motor, 110 volt, 60-cycle, single-phase  
 One compressor, air, portable, electric drive, single-stage, 3.1 cfm at 150#, 20 gal. tank, automatic no-land start, automatic cut-on and cut-off, 1 hp motor, 110 volt, 60-cycle  
 One lubricating unit, power-operated  
 One torch outfit, cutting and welding, oxygen gauge, acetylene gauge, 50 ft. dual hose, cutting tips #101-0-1-2-3, welding tips - 0-1-2-3-4-5-6-7-8-9, cutting goggles fling lighter  
 One truck, hand 2-wheeled, for welding cylinders  
 One tool chest, mechanics 7 drawer  
 One tool chest, heavy duty 7 drawer  
 One cabinet, tool, 4 drawer, with casters  
 One cart, tool, 2-shelf, 4 drawer, with caster 24" x 18" x 34"

### Portable Equipment

One grease gun, hand, lever-operated	One stone, sharpening, mounted
One gun, fluid, direct delivery	One tool kit, carpenter, w/chest
One oiler, hand, forced feed	One blow torch, gasoline, 1 pt cap.
Clamps "C"	One carrier, storage battery
One 2" x 1-3/4" throat	One tachometer, mechanical, continuous
One 4" x 2-1/4" throat	One hammer, hand, sledge, double faced, 8 lb.
One 6" x 2-3/4" throat	One drill, electric, portable 3/4" hand style 6, w/stand
One wrench, impact, electric	One tool kit, diesel injector repair
One jack, hydraulic, 10 ton	One brazing alloy, silver 6 oz.
Two jack, hydraulic, 5 ton	One flux, brazing, silver 8 oz.
One bar, pinch, 5'	One cleaner set, welding and cutting tips
One bar, wrecking, 18"	One cutter, pipe 2" to 3/8"
One caliper, inside, spring joint 6"	One threading set, pipe, rt. hand thd.
One caliper, outside, spring joint 6"	Wrenches,
One compressor, piston ring	One pipe 6"                      Two pipe 10"
One divider, mechanics, steel	One pipe 8"                     Two pipe 14"

### Portable Equipment (cont'd)

One shears, metal cutting,  
left hand, 10"  
One shears, metal cutting,  
right hand, 10"  
One shears, metal cutting,  
straight, 10"  
One puller kit, mechanical,  
w/case  
One face shield for grinder,  
8" visor

One dresser abrasive wheel,  
hand  
One cutter, bolt, 1/2" capacity  
One cutter, tube, 1/8" to  
1-1/8" o.d. w/deburing tool  
One blow gun (airline)  
One engine cylinder compression  
gauge

### Tools

One hammer, hand sledge, double  
faced, 4 lb.  
One drill, electric, portable,  
1/4", hand style  
One drill, electric, portable,  
1/2", hand style 6,  
w/stand  
Two brushes, wire, carbon  
cleaning, for 1/4" drill  
Arbors,  
    One hole saw, #1  
    One hole saw, #2  
    One hole saw, #3  
Blades,  
    One hole saw, 5/8"  
    One hole saw, 3/4"  
    One hole saw, 7/8"  
    One hole saw, 1"  
    One hole saw, 1-1/16"  
    One hole saw, 1-1/8"  
    One hole saw, 1-1/4"  
    One hole saw, 1-3/8"  
    One hole saw, 1-1/2"  
    One hole saw, 1-5/8"  
    One hole saw, 1-3/4"  
    One hole saw, 1-7/8"  
    One hole saw, 2"  
One threading set, screw, rt hand  
thd., N.F. 1/4" to 1"  
One threading set, screw, rt hand  
thd., N.C. 3-48 to 12-24  
One square combination, grooved  
type 12"

One caliper set, micrometer, outside  
0-3"  
One restorer, thread (set)  
One chaser, thread internal 4-24  
thds/inch (set)  
One soldering gun, electric  
One tip, electric soldering gun (box)  
One soldering iron, electric  
5/8" pyramid point  
One soldering iron, electric, pencil  
type  
One wrench, torque 1/2" drive  
5-75 ft-lb.  
One wrench torque, 1/2" drive  
5-250 ft-lb.  
One battery booster cable  
One timing light with spare bulb  
One extractor, screw (set)  
  
One socket wrench set, 1/4" sq drive  
consisting of one standard:

Handle, spinner  
Socket, regular 8-point, 1/4"  
Socket, regular 8-point, 5/16"  
Socket, regular 8-point, 3/8"  
Socket, regular 6-point, 3/16"  
Socket, regular 6-point, 7/32"  
Socket, regular 6-point, 1/4"  
Socket, regular 6-point, 9/32"  
Socket, regular 6-point, 5/16"  
Socket, regular 6-point, 11/32"  
Socket, regular 6-point, 3/8"

## Tools (cont'd)

Socket, regular 6-point, 7/16"  
Socket, regular 6-point, 1/2"  
Adapter, 1/4" Female drive to  
3/8" Male drive

One socket wrench set, 3/8" sq  
drive consisting of one  
standard and one heavy-duty:

Handle, ratchet  
Handle, speeder  
Handle, sliding Tee  
Handle, nut spinner  
Handle, plastic  
Handle, flexible extension  
Ratchet spinner  
Ratchet adapter  
Extension bar, 1-1/2"  
Extension bar, 6"  
Extension bar, 12"  
Universal joint  
Adapter, 3/8" Female drive  
to 1/4" Male drive  
(standard only)  
Adapter, 3/8" Female drive  
to 1/2" Male drive  
(standard only)

One socket wrench set, 3/8" sq  
drive consisting of one  
standard and one heavy-duty:

Socket, regular 8-point,  
1/4"  
Socket, regular 8-point,  
5/16"  
Socket, regular 8-point,  
3/8"  
Socket, regular 8-point,  
7/16"  
Socket, regular 8-point,  
1/2"  
Socket, regular 6-point,  
1/4"  
Socket, regular 6-point,  
5/16"  
Socket, regular 12-point,  
3/8"

Socket, regular 12-point,  
7/16"  
Socket, regular 12-point,  
1/2"  
Socket, regular 12-point,  
9/16"  
Socket, regular 12-point,  
19/32"  
Socket, regular 12-point,  
5/8"  
Socket, regular 12-point,  
11/16"  
Socket, regular 12-point,  
3/4"  
Socket, regular 12-point,  
13/16"  
Socket, regular 12-point,  
7/8"  
Socket, deep, 12-point, 3/8"  
Socket, deep, 12-point, 7/16"  
Socket, deep, 12-point, 1/2"  
Socket, deep, 12-point, 9/16"  
Socket, deep, 12-point, 19/32"  
Socket, deep, 12-point, 5/8"  
Socket, deep, 12-point, 11/16"  
Socket, deep, 12-point, 3/4"  
Socket, deep, 12-point, 13/16"  
Socket, deep, 12-point, 7/8"  
Socket, deep, 12-point, 15/16"  
Socket, deep, 12-point, 1"  
Socket, flexible, regular  
6-point, 3/8"  
Socket, flexible, regular  
6-point, 7/16"  
Socket, flexible, regular  
6-point, 1/2"  
Socket, flexible, regular  
6-point, 5/8"  
Socket, flexible, regular  
6-point, 11/16"  
Socket, flexible, regular  
6-point, 3/4"  
Socket, flexible, regular  
6-point, 7/8"  
Handle, flex, 18"  
Handle, sliding Tee  
Handle, speeder, 19"  
Handle, ratchet, 10"

## Tools (cont'd)

Handle, ratchet, 15"  
Ratchet spinner  
Adapter, ratchet  
Universal joint  
Extension bar, 2"  
Extension bar, 3-1/2"  
Extension bar, 5"  
Extension bar, 10"  
Drag link adjuster (heavy-duty only)  
Stud remover (heavy-duty only)  
Adapter, 1/2" Female drive to 3/8" Male drive (standard only)  
Adapter, 1/2" Female drive to 3/4" Male drive (standard only)  
Socket, regular 8-point 3/8"  
Socket, regular 8-point, 7/16"  
Socket, regular 8-point, 1/2"  
Socket, regular 8-point, 9/16"  
Socket, regular 8-point, 5/8" (heavy-duty only)  
Socket, regular 8-point, 11/16" (heavy-duty only)  
Socket, regular 8-point, 3/4" (heavy-duty only)  
Socket, regular 8-point, 13/16" (heavy-duty only)  
Socket, regular 8-point, 7/8" (heavy-duty only)  
Socket, regular 8-point, 15/16" (heavy-duty only)  
Socket, regular 8-point, 1" (heavy-duty only)  
Socket, regular 6-point, 7/16" (heavy-duty only)  
Socket, regular 6-point, 1/2" (heavy-duty only)  
Socket, regular 6-point, 9/16" (heavy-duty only)

Socket, regular 6-point, 5/8" (heavy-duty only)  
Socket, regular 6-point, 11/16" (heavy-duty only)  
Socket, regular 6-point, 3/4" (heavy-duty only)  
Socket, regular 6-point, 13/16" (heavy-duty only)  
Socket, regular 6-point, 7/8" (heavy-duty only)  
Socket, regular 6-point, 15/16" (heavy-duty only)  
Socket, regular 6-point, 1" (heavy-duty only)  
Socket, regular 6-point, 1-1/16" (heavy-duty only)  
Socket, regular 12-point, 3/8"  
Socket, regular 12-point, 7/16"  
Socket, regular 12-point, 1/2"  
Socket, regular 12-point, 9/16"  
Socket, regular 12-point, 19/32"  
Socket, regular 12-point, 5/8"  
Socket, regular 12-point 11/16"  
Socket, regular 12-point, 3/4"  
Socket, regular 12-point, 25/32"  
Socket, regular 12-point, 13/16"  
Socket, regular 12-point, 7/8"  
Socket, regular 12-point, 29/32"  
Socket, regular 12-point, 15/16"  
Socket, regular 12-point, 1"  
Socket, regular 12-point, 1-1/16"  
Socket, regular 12-point, 1-1/8"  
Socket, regular 12-point, 1-3/16"  
Socket, regular 12-point, 1-1/4"  
Socket, regular 12-point, 1-5/16" (heavy-duty only)  
Socket, deep, 6-point, 1/2" (heavy-duty only)  
Socket, deep, 6-point, 9/16" (heavy-duty only)  
Socket, deep, 6-point, 5/8" (heavy-duty only)  
Socket, deep, 6-point, 11/16" (heavy-duty only)  
Socket, deep, 6-point, 3/4" (heavy-duty only)

## Tools (cont'd)

Socket, deep, 6-point, 13/16" (heavy-duty only)	Handle, flex (heavy-duty only)
Socket, deep, 6-point, 7/8" (heavy-duty only)	Sliding Tee head (heavy-duty only)
Socket, deep, 6-point, 1" (heavy-duty only)	Adapter, ratchet (heavy-duty only)
Socket, deep, 12-point, 1/2" (heavy-duty only)	Extension bar, 3" (heavy- duty only)
Socket, deep, 12-point, 9/16" (heavy-duty only)	Extension bar, 6" (heavy- duty only)
Socket, deep, 12-point, 5/8" (heavy-duty only)	Extension bar, 16" (heavy- duty only)
Socket, deep, 12-point, 11/16" (heavy-duty only)	Adapter, 3/4" Female drive to 1/2" Male drive (heavy-duty only)
Socket, deep, 12-point, 3/4" (heavy-duty only)	Socket, regular 12-point, 15/16" (heavy-duty only)
Socket, deep, 12-point, 13/16" (heavy-duty only)	Socket, regular 12-point, 31/32" (heavy-duty only)
Socket, deep, 12-point, 7/8" (heavy-duty only)	Socket, regular 12-point, 1" (heavy-duty only)
Socket, deep, 12-point, 15/16" (heavy-duty only)	Socket, regular 12-point, 1-1/16" (heavy-duty only)
Socket, deep, 12-point, 1" (heavy-duty only)	Socket, regular 12-point, 1-1/8" (heavy-duty only)
Socket, deep, 12-point, 1-1/16" (heavy-duty only)	Socket, regular 12-point, 1-3/16" (heavy-duty only)
Socket, deep, 12-point, 1-1/8" (heavy-duty only)	Socket, regular 12-point, 1-1/4" (heavy-duty only)
Socket, flexible, 6-point, 9/16" (heavy-duty only)	Socket, regular 12-point, 1-5/16" (heavy-duty only)
Socket, flexible, 6-point, 5/8" (heavy-duty only)	Socket, regular 12-point, 1-3/8" (heavy-duty only)
Socket, flexible, 6-point, 11/16" (heavy-duty only)	Socket, regular 12-point, 1-7/16" (heavy-duty only)
Socket, flexible, 6-point, 3/4" (heavy-duty only)	Socket, regular 12-point, 1-1/2" (heavy-duty only)
Socket, flexible, 6-point, 13/16" (heavy-duty only)	Socket, regular 12-point, 1-9/16" (heavy-duty only)
Socket, flexible, 6-point, 7/8" (heavy-duty only)	Socket, regular 12-point, 1-5/8" (heavy-duty only)
One socket wrench set, 3/4" sq drive consisting of one standard and one heavy-duty:	Socket, regular 12-point, 1-11/16" (heavy-duty only)
Handle, ratchet (heavy-duty only)	Socket, regular 12-point, 1-3/4" (heavy-duty only)
	Socket, regular 12-point, 1-13/16" (heavy-duty only)

Tools (cont'd)

Socket, regular 12-point,  
1-7/8" (heavy-duty only)  
Socket, regular 12-point,  
2" (heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 3/8" & 7/16"  
Wrench, box, double offset,  
long 12-point, 7/16" & 1/2"  
(heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 1/2" & 9/16"  
Wrench, box, double offset,  
long 12-point, 9/16" & 5/8"  
(heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 19/32" & 11/16"  
Wrench, box, double offset,  
long 12-point, 5/8" & 11/16"  
(heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 5/8" & 3/4"  
Wrench, box, double offset,  
long 12-point, 11/16" & 13/16"  
(heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 3/4" & 7/8"  
Wrench, box, double offset,  
long 12-point, 25/32" & 13/16"  
Wrench, box, double offset,  
long 12-point, 7/8" & 15/16"  
Wrench, box, double offset,  
long 12-point, 15/16" & 1"  
(heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 1" & 1-1/8"  
Wrench, box, double offset,  
long 12-point, 1-1/16" &  
1-1/8" (heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 1-1/16" &  
1-1/4"  
Wrench, box, double offset,  
long 12-point, 1-3/16" &  
1-5/16" (heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 1-1/4" &  
1-3/8" (heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 1-3/8" &  
1-1/2" (heavy-duty only)  
Wrench, box, double offset,  
long 12-point, 1-7/16" &  
1-3/8" (heavy-duty only)  
Wrench, box, double offset,  
short 12-point, 5/16" &  
3/8" (heavy-duty only)  
Wrench, box, double offset,  
short 12-point, 3/8" &  
7/16" (heavy-duty only)  
Wrench, box, double offset,  
short 12-point, 7/16" &  
1/2" (heavy-duty only)  
Wrench, box, double offset,  
short 12-point, 1/2" &  
9/16" (heavy-duty only)  
Wrench, box, double offset,  
short 12-point, 9/16" &  
5/8" (heavy-duty only)  
Wrench, box, double offset,  
short 12-point, 5/8" &  
3/4" (heavy-duty only)  
Wrench, box, double offset,  
short 12-point, 11/16" &  
13/16" (heavy-duty only)  
Wrench, box and open end,  
combination long handle,  
12-point, 3/8"  
Wrench, box and open end,  
combination long handle,  
12-point, 7/16"  
Wrench, box and open end,  
combination long handle,  
12-point, 1/2"  
Wrench, box and open end,  
combination long handle,  
12-point, 9/16"  
Wrench, box and open end,  
combination long handle,  
12-point, 5/8"  
Wrench, box and open end,  
combination long handle,  
12-point, 11/16"  
Wrench, box and open end  
combination long handle,  
12-point, 3/4"

## Tools (cont'd)

- Wrench, box and open end combination long handle, 12-point, 13/16"
- Wrench, box and open end combination long handle, 12-point, 7/8"
- Wrench, box and open end combination long handle, 12-point, 15/16"
- Wrench, box and open end combination long handle, 12-point, 1"
- Wrench, open-end, double offset short handle, 11/64" & 15/64" (standard only)
- Wrench, open-end, double offset short handle, 15/64" & 13/64" (standard only)
- Wrench, open-end, double offset short handle, 7/32" & 1/4" (standard only)
- Wrench, open-end, double offset short handle, 9/32" & 5/16" (standard only)
- Wrench, open-end, double offset short handle, 15/16" & 9/32" (standard only)
- Wrench, open-end, double offset short handle, 11/32" & 3/8" (standard only)
- Wrench, open-end, double offset short handle, 3/8" & 11/32" (standard only)
- Wrench, open-end, double offset long handle, 1/4" & 5/16"
- Wrench, open-end, double offset long handle, 5/16" & 3/8"
- Wrench, open-end, double offset long handle, 3/8" & 7/16"
- Wrench, open-end, double offset long handle, 7/16" & 1/2"
- Wrench, open-end, double offset long handle, 1/2" & 9/16"
- Wrench, open-end, double offset long handle, 9/16" & 5/8"
- Wrench, open-end, double offset long handle, 19/32" & 11/16"
- Wrench, open-end, double offset long handle, 5/8" & 11/16"
- Wrench, open-end, double offset long handle, 5/8" & 3/4"
- Wrench, open-end, double offset long handle, 11/16" & 3/4"
- Wrench, open-end, double offset long handle, 3/4" & 7/8"
- Wrench, open-end, double offset long handle, 25/32" & 13/16"
- Wrench, open-end, double offset long handle, 7/8" & 15/16"
- Wrench, open-end, double offset long handle, 15/16" & 1"
- Wrench, open-end, double offset long handle, 1" & 1-1/8" (heavy-duty only)
- Wrench, open-end, double offset long handle, 1" & 1-1/16" (heavy-duty only)
- Wrench, open-end, double offset long handle, 1-1/16" & 1-1/4"
- Wrench, open-end, double offset long handle, 1-3/16" & 1-5/16" (heavy-duty only)
- Wrench, open-end, double offset long handle, 1-1/16" & 1-3/8" (heavy-duty only)
- Wrench, open-end, double offset long handle, 1-3/8" & 1-1/2" (heavy-duty only)
- Wrench, open-end, double offset long handle, 1-7/16" & 1-5/8"
- Wrench, open-end, adjustable, 4"
- Wrench, open-end, adjustable, 6"
- Wrench, open-end, adjustable, 8"
- Wrench, open-end, adjustable, 10"
- Wrench, open-end, adjustable, 12"
- Wrench, open-end, adjustable, 15" (heavy-duty only)



## Tools (cont'd)

Pliers, battery terminal, 7"  
Pliers, combination, utility,  
8" (heavy-duty only)  
Pliers, diagonal cutting,  
short nose (heavy-duty only)  
Pliers, diagonal cutting, 4"  
Pliers, diagonal cutting, 6"  
Pliers, gas 6"  
Pliers, ignition (standard  
only)  
Pliers, gripping 7-1/2"  
(standard only)  
Pliers, long round nose, 6"  
Pliers, needle nose, with  
side cutter (standard only)  
Pliers, slip joint, angle  
nose, 5"  
Pliers, slip joint, angle  
nose, 8"  
Pliers, slip joint, angle  
nose, 10" (heavy-duty only)  
Pliers, vice grip 7"  
Pliers, vice grip, 10" (heavy-  
duty only)  
Screwdrivers, flat tip, plastic  
handle, 1/8" x 3"  
Screwdriver, flat tip, plastic  
handle, 1/4" x 1-1/2"  
Screwdriver, flat tip, plastic  
handle, 3/16" x 2-1/2"  
Screwdriver, flat tip, plastic  
handle, 1/4" x 4"  
Screwdriver, flat tip, plastic  
handle, 5/16" x 6"  
Screwdriver, flat tip, plastic  
handle, 3/8" x 8"  
Screwdriver, flat tip, plastic  
handle, 7/16" x 8"  
Screwdriver, Phillips-head,  
plastic handle, #1 -  
3/16" x 1"  
Screwdriver, Phillips-head,  
plastic handle, #2 -  
1/4" x 1-1/2"  
Screwdriver, Phillips-head,  
plastic handle, #1 -  
3/16" x 3"  
Screwdriver, Phillips-head  
plastic handle, #2 -  
1/4" x 4"  
Screwdriver, Phillips-head  
plastic handle, #3 -  
5/16" x 6"  
Screwdriver, Phillips-head,  
plastic handle, #4 -  
3/8" x 8"  
Screwdriver, offset,  
Phillips-head, #1 & 2  
Screwdriver, offset,  
Phillips-head, #2 & 3  
Screwdriver, offset,  
Phillips-head, #3 & 4  
Screwdriver, spark tester,  
flat blade, 5-1/8"  
Hammer, hand, ball peen, 4 oz.  
Hammer, hand, ball peen, 12 oz.  
Hammer, hand, ball peen, 32 oz.  
(heavy-duty only)  
Hammer, hand, plastic head  
Punch, drive pin, straight type,  
1/16" (standard only)  
Punch, drive pin, straight type,  
3/32" (standard only)  
Punch, drive pin, straight type,  
1/8" (standard only)  
Punch, drive pin, straight type,  
5/32"  
Punch, drive pin, straight type,  
3/16"  
Punch, drive pin, straight type,  
7/32"  
Punch, drive pin, straight type,  
1/4"  
Punch, drive pin, straight type,  
5/16"  
Punch, drive pin, straight type,  
3/8"  
Punch, drive pin, tapered,  
1/16" (standard only)  
Punch, drive pin, tapered,  
1/8" (standard only)  
Punch, drive pin, tapered,  
3/16"

## Tools (cont'd)

Punch, drive pin, tapered,  
1/4"  
Punch, drive pin, tapered,  
5/16"  
Punch, center, solid,  
1/8" x 4"  
File, hand, flat, 6"  
File, hand, flat, 8"  
File, hand, flat, 10"  
File, hand, flat, 12"  
File, hand, round, 6"  
File, hand, round, 8"  
File, hand, round, 10"  
File, hand, round, 12"  
Handles, file, wood,  
1" x 4"  
Handles, file, wood,  
1-1/4" x 4-1/2"  
Key, socket head screw,  
hexdrive, .050"  
(standard only)  
Key, socket head screw,  
hexdrive, 1/16"  
(standard only)  
Key, socket head screw,  
hexdrive, 5/64"  
(standard only)  
Key, socket head screw,  
hexdrive, 3/32"  
Key, socket head screw,  
hexdrive, 1/8"  
Key, socket head screw,  
hexdrive, 5/32"  
Key, socket head screw,  
hexdrive, 3/16"  
Key, socket head screw,  
hexdrive, 7/32"  
Key, socket head screw,  
hexdrive, 1/4"  
Key, socket head screw,  
hexdrive, 5/16"  
Key, socket head screw,  
hexdrive, 3/8"  
Key, socket head screw,  
hexdrive, 1/2"  
Key, socket head screw,  
hexdrive, 9/16"

Key, socket head screw, hexdrive,  
5/8"  
Bar, pinch, 1/2" x 13-1/2"  
Bar, pinch, 3/4" x 24"  
(heavy-duty only)  
Bar, pry, 17/32" x 16"  
Frame, hand hacksaw with 12 blades,  
18 teeth/inch  
24 teeth/inch  
32 teeth/inch  
Scraper, carbon, flexible, 1" x 9"  
Knife, putty, 1-1/4" blade  
(standard only)  
Knife, putty, 2" blade (heavy-  
duty only)  
Pick-up tool, magnetic, large  
(standard only)  
Pick-up tool, magnetic, pocket,  
(standard only)  
Wrenches, open-end fixed, (tappet)  
Two 7/16" x 1/2" (standard only)  
Two 1/2" x 9/16" (standard only)  
Two 5/8" x 11/16" (standard only)  
Tape, measuring, 8 foot  
Rule, steel, machinist, 6" long,  
1/32" one side, 1/10" other side  
(standard only)  
Gage, thickness, english system,  
25 blades  
Gage, thickness, english system,  
13 blades (standard only)  
Gage, gap-setting, set of 8  
angular wire  
Tool kit, automotive, electrical,  
ignition (standard only)  
Tool kit, diesel injector repair  
(heavy-duty only)  
Chisel, cold, hand, 1/4"  
(standard only)  
Chisel, cold, hand, 5/16"  
(standard only)  
Chisel, cold, hand, 3/8"  
(standard only)  
Chisel, cold, hand, 7/16"  
Chisel, cold, hand, 1/2"  
Chisel, cold, hand, 5/8"  
Chisel, cold, hand, 3/4"  
Chisel, cold, hand, 7/8" (heavy-  
duty only)